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DOI:
10.3390/educsci7010036

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (Harvard):
Herring, N, Davies, P & Lundholm, C 2017, 'Learning economics and attitudes to market solutions to environmental problem', *Education Sciences*, vol. 7, no. 1, pp. 1-15. https://doi.org/10.3390/educsci7010036

education sciences

MDPI

Article

Learning Economics and Attitudes to Market Solutions to Environmental Problems

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Academic Editor: Michael Brody
Received: 3 November 2016; Accepted: 20 February 2017; Published: 1 March 2017

Abstract: Climate change challenges governments to reduce emissions, and to gain support for such actions from their citizens. This can be in the form of taxation or legislation, or other forms of government interventions. In previous research, several instruments have been developed to capture attitudes towards the roles of markets and governments in the economy. Some of these instruments have assumed that respondents will have the same attitude towards the role of markets and governments, regardless of the context (e.g., welfare, environment, health) or the form of government intervention (law, taxation, subsidy, spending etc.). However, these studies have not examined attitudes towards, or belief in, the efficacy of government intervention in markets, through microeconomic policies on taxation (e.g., duties levied on particular products) or subsidies. This paper reports on the results of taking such a specific focus, that is, investigating economics students' knowledge of, and attitudes towards, government interventions in markets, specifically addressing the problem of climate change. We make use of unique, two-wave longitudinal data from Swedish university students. The data were collected during their initial semester at the university. The first data collection was performed at the beginning of the semester, August/September 2014, and the second wave of data collection was performed in December/January 2014/2015, at the end of the semester. We were able to match 414 students between the first and second survey. The results show that students of economics change their policy attitudes and become more knowledgeable in economics. After one semester, they are more likely to think of economic instruments/incentives (taxes and subsidies) as good and efficient policy instruments, and less likely to think that other instruments (regulation and information) are good and efficient policy instruments. However, further analyses show that knowledgeable students do not have different attitudes toward environmental policy instruments, compared to students who do not answer the questions correctly. Hence, there seems to be some other factor affecting students in economics during their first semester, that changes their attitudes towards environmental policy instruments.

Keywords: public understanding of economics; economic socialization; climate change; instructional effects on attitudes

1. Introduction

Governments attending the Paris Climate Conference in December 2015 [1] declared their commitment to keeping world temperature levels at no more than two degrees higher than

pre-industrial levels. The presumption is that it is feasible to achieve this target through environmental policies, which may take the form of market interventions through taxes and subsidies, regulations, or information and persuasion. One question for society is: 'How effective will these policies be?' A second question is: 'Will there be public support for any of these policies?' Education may play a role in developing experts who will design and evaluate policies. It may also play a role in developing public understanding [2]. According to [3], the public understanding of climate change in the US is riddled with misconceptions, which influence individual behaviour and attitudes towards government interventions to promote environmental sustainability. One place where we might expect to observe an educational effect is in undergraduate economics. Economists play prominent roles in the design of government policies and an economics education might be expected to dispel misconceptions about the efficacy of policy instruments. However, education faces substantial challenges in changing attitudes, not least in the context of societal response to environmental problems [4].

Studies of curriculums and textbooks in economics show that a sustainability perspective can be hard to integrate within mainstream economics, not least at an undergraduate level. At the same time, introductory economics deals with concepts that are highly relevant from a sustainability perspective. These references are concentrated in microeconomics, such as market interventions to deal with negative externalities (e.g., government regulation on pollution) (cf. [5,6]). Existing evidence tells us rather little about the effect of economic teaching on the understanding of, and attitudes towards, environmental issues [7]. We know very little about the effects of basic knowledge in economics on sustainability attitudes, even though it is common in many countries to take introductory courses in economics, or take economics as a minor, while majoring in another discipline.

We investigated the role of current undergraduate teaching in economics on students' support for alternative instruments in environmental policy. We examined the change in knowledge and support for policies amongst undergraduate economists. Across our whole sample, we found a small increase in support for, and belief in, the efficacy of market-based interventions, relative to non-market based interventions. However, we did not find an association between the knowledge of relevant economic policies and the support for their use.

The paper is organised as follows. First, we review existing research, which informed the framing of the research questions. We then describe the collection of data through two surveys of undergraduate students, before presenting our results. The paper concludes with a discussion of possible interpretations of our results and the implications these may have for teaching, policy, and future research.

2. Attitudes towards Market Solutions to Environmental Problems

In this section, we summarise previous research, which bears upon our interest in attitudes towards different forms of environmental policy and the effect that education might have on these attitudes. We begin with studies that have explored general attitudes towards governments and markets in the economy, before narrowing our focus to attitudes in the context of environmental policy. We then complete this section by reviewing evidence of the effect of education on these attitudes.

2.1. General Attitudes towards Markets and Government in the Economy

Attitudes towards a particular policy (e.g., taxation) in a particular context (e.g., environmental protection) might be embedded within a broad attitude towards the appropriate roles of governments and markets. This is implied by survey instruments (e.g., [8,9]) which use items that generalise across contexts (e.g., "It's not the business of the government to control prices" in [9]). These broad brush statements conflate beliefs about the efficacy of policy instruments (such as price control, taxes, or subsidies), with trust in the capacity of governments to use these instruments in the public interest.

Some other studies [10–12] have made a priori judgements that individuals will adopt different stances towards the role of the government, according to the context (e.g., welfare, environment, health). For example, Lephardt and Breeden [13] include one item: "in my opinion the market system

in the US encourages abuse of the environment". When the research design has left a question open, data analysis has suggested that individuals adopt different attitudes towards the role of governments, according to the context of the intervention. Davies and Parker [14] reported that attitudes towards subsidies for agricultural prices were loaded on one factor, whilst attitudes towards general government intervention in markets were loaded on another factor. Other research [15,16] has reported that school students adopt very different stances towards the role of government intervention in different sectors of the economy. There is, currently, very little research regarding attitudes towards particular forms of government policy in particular contexts. Shiller et al. [17] reported that adults in the US and the USSR preferred taxation to rationing as a method of reducing the consumption of petrol, but that we do not know the extent to which this difference applies in other contexts.

Moreover, individuals vary in the rationale that they use to justify government intervention, and may also use one justification for an intervention in one context, and a different justification for an intervention in another context. Several studies (e.g., [18,19]) have focused exclusively on the beliefs about whether markets offer a fair way of allocating goods and services. Other studies (e.g., [20]) have distinguished between attitudes towards the fairness of an allocation system and attitudes towards its functionality or efficiency. Few studies have tried to reveal which ideas respondents are using to inform their attitudes (either towards fairness or efficiency). Davies et al. [15,16] reported that school students rarely referred to externalities (such as environmental damage) when justifying their support for government intervention.

2.2. Attitudes towards Sustainability and Environmental Policy

An extensive amount of literature (e.g., [21–24]) has developed and applied 'value-belief-norm theory' and the theory of planned behaviour, to the analysis of attitudes towards sustainability and environmental policy. This literature suggests that attitudes depend on the interaction between values and beliefs about (i) the vulnerability of the environment and (ii) the efficacy of actions to address that vulnerability. Three sets of values are relevant to this study: the valuation of the natural environment, trust in other citizens (social trust) and in the public authorities (trust in institutions), and the valuation of equity. Support for a carbon tax may be affected by the extent to which an individual regards the environment as possessing intrinsic value, whether they believe that a government is simply trying to increase its own scope for action at the expense of individual freedom, and whether they think that the burden of tax should fall on polluters, regardless of the capacity to pay. If these underlying values are powerful and resistant to change, they could limit the scope for education to affect attitudes towards environmental policies. For example, Tikir and Lehmann [24] reported that the intentions of staff and students at one Swiss university to use public transport were more strongly related to underlying values and norms than beliefs about the efficacy and feasibility of the actions. Individuals who are largely driven by egoistic motives are more likely to be influenced by convenience and personal incentives than by reasoned arguments. De Leeuw et al. [25] reported that the pro-ecological intentions of the high school students in their study were increased by enabling factors (such as the availability of a copier that printed on both sides) more than by beliefs about the effect of pro-environmental behaviours (such as the benefits of saving energy in the home). D'Souza et al. [26] surveyed adult attitudes to adjusting price or quality for increasing environmental sustainability. They reported that consumers were more willing to pay a higher price than suffer lower quality, in order to secure environmental sustainability. The power of these underlying values will be greater if, as value-belief-norm theory and the theory of planned behaviour allow, beliefs are framed by underlying values; an individual is less likely to believe that a carbon tax will curb climate change if they do not trust governments and disregard the environmental effects on others.

Mainstream economics takes a different view of the relationship between values and beliefs. Individuals are assumed to be rational (unbiased) decision-makers and introductory textbooks espouse the separation of 'positive' and 'normative' judgements as a cornerstone of the subject [27,28]. This observation highlights one of two remaining ways in which education may influence attitudes

towards environmental policies. Value-belief-norm theory and the theory of planned behaviour suggest that attitudes are framed, in part, by social norms. These include whatever is taken for granted in an individual's society. Davies and Lundholm [16] found that young people's views about whether several goods and services should be available for free, was shaped by their personal experience. Norms are also established by socialisation, into roles by gender and social class. Davies et al. [29] reported evidence from a survey of secondary school students in England. They found that females were more likely to support government spending in a range of contexts than males, but females were less likely to support higher levels of taxation. O'Brien and Ingels [9] argued that there is no relationship between the socio-economic background of US high school students and the 'support for business', using their Economics Values Inventory. However, they did find that students from lower socio-economic backgrounds were more positive towards government intervention in social welfare.

Aside from the reasoned arguments about the efficacy of policy instruments, learning economics involves the induction of a set of taken-for-granted assumptions, which may shape a student's attitudes. Finally, of course, learning economics is intended to affect beliefs associated with the efficacy of policy instruments: e.g., the implications of the demand of price inelasticity for the effect of a sales effect; the effect of price controls on total welfare and market efficiency. However, education which changes belief about the efficacy of policy instruments may have little effect if attitudes are more dependent on beliefs about environmental vulnerability, than beliefs about policy instruments. Students who believe that environments face little threat from human activity [30] are unlikely to be too concerned about the efficacy of environmental policy instruments.

2.3. The Effect of Studying Economics on Attitudes towards the Role of Government in the Economy

There is some evidence suggesting that students' general academic attainment is associated with particular attitudes towards the role of the government and particular policy instruments. O'Brien and Ingels [9] reported that the US high school students they surveyed were slightly, but significantly, more likely to be supportive of 'the American economic system' and 'against the government control of prices', if they scored more highly on seven items which they used to test their economic knowledge. Davies et al. [15] reported that English secondary school students with higher levels of academic attainment were more likely to support progressive income tax.

Surveys of students of business or economics (e.g., [11,18–20,31]) routinely find that they are more 'pro-market' than other students. However, as noted by some of these researchers, this could simply be a selection effect: students who are more pro-market may be more likely to choose to study these subjects. Studies which have explicitly aimed to distinguish between selection effects and the effects of instruction, have reported mixed results. Whaples [31] found a small shift towards a belief that 'markets are fair' during the course of economics students' first year of study. However, Cokgezen and Cilingirturk [12] found that these results were not replicated with their sample of Turkish undergraduates in Istanbul. We found one previous study that investigated the association between undergraduates' economic beliefs and their attitudes towards environmental policies. An experimental study [32] found no relationship between undergraduates' understanding of the operation of taxation of 'environmentally damaging products', and support for such taxes. The design of this study precluded the consideration of any effect over time of teaching economics upon students' attitudes. We found one study that did examine the change in attitude over time [33]. This study compared the responses of undergraduates at the start and end of a semester at one US university. The research showed that students who initially did not share their professors' views about economic responses to environmental damage, were more likely to agree with their professor after a course in economics [33]. This applied to attitudes towards government taxation and the consumer boycotting of goods which damaged the environment. The study did not examine the relationships between these expressions of attitude and students' economic understanding.

3. Methods

3.1. Research Design, Ethics, and Justification

Our research questions were:

1. Do first year undergraduates change their attitudes towards common microeconomic environmental policy instruments following one semester of economics teaching?
2. Following one semester of economics teaching, is there any change in undergraduates' microeconomic economic reasoning relevant to environment policies?
3. Is there any association between the change in undergraduates' attitudes towards environmental policy instruments and the change in their microeconomic economic reasoning?

To answer research questions 1 and 2, we compared the mean scores of survey responses to items on attitudes towards policy instruments, and multiple choice questions on the microeconomics of resource allocation, markets, and government intervention. To answer question 3, we first used a cross-sectional Ordinary Least Squares (OLS) regression of the form:

$$Y_i = f(S_i,\ K_i) \tag{1}$$

where Y_i is the student's attitude towards market-based and non-market-based policy instruments to address economic problems; S_i is a vector of student characteristics including gender, generalized trust, and trust in institutions and personal environment norm; and K_i is a measure of student i's relevant economic knowledge. Finally, we conducted a difference in difference analysis to examine the relationships between a change in economic knowledge and a change in attitudes, using the same student characteristics as in Equation (1).

To answer these questions, we made use of a unique data set of students in economics, political science, and law, from seven universities and university colleges in Sweden. The students in political science and law did not study either microeconomics or macroeconomics. We use their responses to the survey questions as a control, whilst focusing on the students who did study microeconomics. At one of the universities, we did not capture economics students, so for the specific analyses of economics' students, we include six universities in the sample. We make a brief reference to differences between students studying economics and students studying other subjects, and report on these comparisons in more detail elsewhere [34]. We created a two-wave panel data set through a repeated survey of one cohort of students. Ethical procedures followed the principles of the Declaration of Helsinki, 1975. Participants were invited to give informed consent and their identities were kept anonymous at the point of data entry and analysis, through the allocation of codes which were retained to identify students at the point of the second survey. To preserve student anonymity, we matched the first and second waves through a question about parents' first names and if there was ambiguity through comparing handwriting. The ethical procedures were approved by the Swedish Research Council (2011-05991). There are few longitudinal studies of economics students, and we know of no study that has investigated the relationships between a change in economics students' perceptions of environmental policy instruments and a change in their economic reasoning. By making use of a longitudinal design, we can be more confident of separating selection effects from course effects. Except for experimental designs based on randomization, we consider longitudinal studies as one of the stronger approaches for studying the role of education in developing attitudes [35].

The first data collection was made during the students' first weeks participating in their course in economics (August/September 2014), which we consider as close to a pre-test as possible. We would, of course, have preferred to measure their attitudes and knowledge just before the semester started. However, this is almost impossible, since several students change subject just before they start the semester. The second data-collection was carried out at the end of the semester (in December 2014/January 2015, as applicable in each university). A substantial number of Swedish undergraduates study one semester of economics. This motivated the timescale in our longitudinal design.

3.2. Instrument

Since we were interested in students' attitudes towards different policies, we had to make a choice between specific policies, and we also had to choose how to describe these policies. Based upon our reading of distinctions, which are deemed salient in mainstream economics (see for example, Ref. [28]) and also in political theory [36], we identified four groups of policies: taxes, subsidies, regulation, and information. We categorised taxes and subsidies as 'market-based instruments', and categorised regulation and information as 'non-market-based instruments'. We introduced these four items with the preamble: "There are various ways to get ordinary people in Sweden to protect the environment. What do you think about the following suggestions?" Students were then asked to rate each of these suggestions: "Impose consumption taxes on polluting consumption"; "impose more regulations and prohibitions to prevent people from harming the environment"; "subsidize environmentally friendly consumption"; and "provide more information and education to people about the benefits of protecting the environment". Students were asked to rate each proposal on a five point Likert scale, from 'very bad suggestion' to 'very good suggestion'. We chose this format rather than asking students to rank the policy options in order of their preference (cf. [37]), as a student might think each of the policies was either 'very bad' or 'very good'. We also asked the students to judge the efficiency of each of the four policy instruments (also using a five point Likert-scale). In this way, we were able to capture their views on the efficiency of the various policies and we found that these measures are correlated. For example, the correlation between comparing the acceptance of taxes and the perceived efficiency of taxes is 0.52.

We tested relevant economic reasoning through multiple choice questions. We identified four areas of interest, as summarised in Table 1. For each topic, we identified four questions for a trial study with the previous cohort of undergraduate students. Five questions were taken from the Test of College Understanding in Economics (TUCE); seven questions were taken from A-level examination papers in England; two questions were taken from past first year examinations at one of the participating universities; one was taken from the question bank provided by the Economics Network in the UK; and one was taken from [38]. We chose these sources on the basis of the judgements about the validity and reliability employed when designing items.

Table 1. Economic reasoning of first year undergraduate students identified as relevant to attitudes towards environmental policy.

Topic	Key Issues in Students' Conceptions
Opportunity cost	Do students use opportunity cost in their evaluation of environmental consequences of private or public economic actions?
Supply, demand and the efficiency of markets	How do students understand interactions between price, demand and supply in market contexts? Are students able to use the concept of efficiency in evaluating the role of markets in economic problems?
Externalities	Do students use conceptions of positive and negative externalities in their evaluations of the consequences of relying on markets to solve economic problems?
Government policy to address market failure in the context of environmental problems	How do students understand the likely effects of regulation, indirect taxation, price controls and permits in the context of markets and economic welfare?

The questions capture a student's knowledge of microeconomics, which is a fundamental part of first year undergraduate economics at all the universities in the study. The distribution of micro-economics during the first semester is reported in Table 2.

Table 2. Credits (indicating course size) in introductory courses in economics at six Swedish universities.

University	Microeconomics	Macroeconomics	Other Courses *
University 1	7.5	7.5	15
University 2	15	15	
University 3	7.5	7.5	15
University 4	8	14.5	7.5
University 5	15	15	
University 6	11	9	5

Notes: * Financial economics, applied economics, basics of market economy, politics of economics, foreign trade, international economics.

For the survey used in this study, we reduced our selection of questions to four, given the limited time we could allocate to this part of the survey (see Appendix A). For each topic in Table 1, we selected the question where the proportion of students choosing the correct answer was close to 50%, and where there was a more even split between the students choosing each of the distractors. We used this second criterion as an indicator of the credibility of the distractors to the students. Two of the questions were used in both surveys, while one question was exchanged in order to control for potential panel effects (i.e., that being exposed to a question in itself has an effect).

3.3. Sample Selection, Size and Descriptive Details

Included in the sample are six universities in Sweden with large cohorts of students studying economics in their first year. One university declined to participate. Hard copy surveys were administered in core lectures, to maximise response rates. Participation was voluntary, but rewarded with cinema tickets. Accurate response rates are difficult to calculate as there is a high rate of students switching between first year modules. In our total sample (n = 882), 48% were economics students. The rest of the group consists of students from two adjacent disciplines (political science (22%) and law (30%)). The sample sizes for each university are provided in Table 3. We checked for potential bias in our results using multiple imputation in Stata version 13 (StataCorp, College Station, Texas, USA). A comparison of the imputed results with the results from listwise deletion, indicated no substantive differences. We therefore report the results from the listwise deletion analysis, as these are more straightforward to present.

Table 3. The sample sizes.

		Participants in Pre-Survey	Participants in End-Point Survey	Participants on Both Surveys
University 1	Economics	46	36	19
	Political Science	79	49	36
University 2	Economics	265	173	73
	Law	190	144	99
	Political Science	102	103	58
University 3	Economics	130	76	56
	Law	144	158	100
	Political Science	53	39	32
University 4	Economics	172	123	90
	Political Science	85	62	48
University 5	Economics	90	75	57
	Law	75	88	55
	Political Science	50	42	34
University 6	Economics	243	140	88
University 7	Law	77	59	37
	Total	*1801*	*1367*	*882*

Our survey instrument gathered data on student characteristics which, according to our review of previous research, might influence undergraduates' attitudes towards environmental policies (see also [21,39]).

Social trust and trust in institutions are likely to encourage students to be broadly supportive of government intervention (since these students are more likely to believe that governments will act in the public interest). We used two questions to capture social trust: "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" and "Generally speaking, do you think that most people would try to take advantage of you if they got the chance, or would they try to be fair?"; questions that are commonly used in order to measure generalized trust. The latter is, for example, based on the question in the World Values Survey. As expected, responses to these questions were positively correlated (Cronbach's α: 0.71). Several studies of pro-environmental policy acceptance have highlighted that trust in institutions affects support for policy implementation (e.g., [37,40,41]). In order to capture trust in institutions, we used an item from a survey battery, where the respondents are asked whether their level of trust in a number of actors are trustworthy, including "Swedish authorities", on a five-point-scale: "What level of trust do you have in the following institutions and groups? A great deal of trust; Quite a lot of trust; Neither a lot nor little trust; Little trust; Very little trust".

We also included measurement of environmental protection norms, derived from value-belief-norm theory (ascribed personal environmental responsibility). We used the following items (in which students were asked to respond on a five point scale, from "disagree strongly" to "agree strongly"): 'There is no point that I do what I can for the environment unless others do too'; 'As long as all laws and regulations are adhered to, there is no reason for Swedish consumers to be concerned about possible environmental damage in other countries'; 'My own lifestyle has contributed to the current environmental problems'; 'I am co-responsible for protecting the world's environment'; 'Ordinary citizens and not just authorities and decision makers carry a great deal of responsibility for the environment'; 'I have no personal responsibility to protect the environment'; and 'I could forgo holiday air travel to reduce emissions of greenhouse gases'. These items were well correlated (Cronbach's α 0.72). A summary of sample characteristics is presented in Table 4.

We also control for ideological positions, measured at the first wave by the following item: "It is sometimes said that political opinions can be placed on a left-right scale. Where would you place yourself on such a scale?" where the respondents could place themselves on a five point Likert scale, from "Clearly to the left" to "Clearly to the right".

Table 4. Sample characteristics matched group—both waves (August/September 2014 and December 2014/January 2015).

Economists	**Wave 1**				**Wave 2**			
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Gender	0.56	0.50	0	1				
Ideological position (left-right)	3.33	1.23	1	5				
Acceptance market-based environmental policy measures	3.79	0.74	1	5	3.93	0.69	1	5
Acceptance "other" environmental policy measures	3.95	0.61	1	5	3.87	0.68	1	5
Trust in institutions	3.48	0.81	1	5	3.50	0.87	1	5
Social trust	3.23	0.84	1	5	3.19	0.87	1	5
Knowledge	0.68	0.66	0	2	0.97	0.72	0	2
Ascribed personal environmental responsibility	3.87	0.53	1	5	3.84	0.55	1	5
Law students								
Gender	0.67	0.47	0	1				

Table 4. *Cont.*

Economists	Wave 1				Wave 2			
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Ideological position (left-right)	3.11	1.36	1	5				
Acceptance market-based environmental policy measures	3.75	0.86	1	5	3.75	0.77	1	5
Acceptance "other" environmental policy measures	3.99	0.68	1.5	5	3.89	0.72	1	5
Trust in institutions	3.49	0.83	1	5	3.48	0.85	1	5
Social trust	3.19	0.85	1	5	3.18	0.84	1	5
Knowledge	0.74	0.68	0	2	0.67	0.68	0	2
Ascribed personal environmental responsibility	3.89	0.63	1.29	5	3.83	0.65	1.29	5
Political scientists								
Gender	0.70	0.46	0	1				
Ideological position (left-right)	2.48	1.29	1	5				
Acceptance market-based environmental policy measures	4.00	0.745	1	5	4.02	0.73	1	5
Acceptance "other" environmental policy measures	4.19	0.55	2	5	4.15	0.60	1	5
Trust in institutions	3.69	0.75	1	5	3.80	0.74	1	5
Social trust	3.53	0.74	1	5	3.44	0.85	1	5
Knowledge	0.70	0.73	0	2	0.85	0.70	0	2
Ascribed personal environmental responsibility	4.10	0.52	2.29	5	4.03	0.53	2	5

4. Results

4.1. Changes in Policy Attitudes among Students in Economics after One Semester

Aggregate results are summarised in Table 5. These show a small increase in economics students' acceptance of market-based instruments and a small decrease in acceptance of non-market-based instruments. The increase in the acceptance of market-based policies was largely driven by greater support for the use of subsidies. Survey responses from other students studying law or politics did not show a significant change regarding market-based institutions. Law students do, however, become less accepting of the other instruments.

Table 5. Acceptance of different policy tools among first semester students in economics, law, and political science. Mean values are presented for wave 1 and wave 2.

Policy Option	Wave 1	Wave 2	Difference	*n*
Acceptance market-based instruments (economists)	3.79	3.94	0.14 ***	377
Acceptance "other" instruments (economists)	3.95	3.87	−0.07 *	377
Acceptance market-based instruments (law)	3.75	3.75	0.00	288
Acceptance "other" instruments (law)	3.99	0.89	−0.10 *	288
Acceptance market-based instruments (political scientists)	4.00	4.02	0.02	207
Acceptance "other" instruments (political scientists)	4.19	4.15	0.04	207

Notes: * $p < 0.05$; *** $p < 0.001$.

4.2. Changes in Knowledge among Students in Economics after One Semester

First, we observed no difference between the students enrolled in economics modules and the students enrolled in law and politics modules, in terms of the average performance on the economics multiple choice questions in the first survey. There did not appear to be any self-selection effect on

the knowledge of economics. However, the students enrolled on the economics modules improved their performance on the two questions that were included in both surveys. The proportion of students in economics modules giving the correct answer increased from 34% to 51% on question 1 (on supply, demand, and the efficiency of markets), and from 32% to 45% on question 2 (on government policy to address market failure in the context of environmental problems). There was no change between the two surveys in the performance of students enrolled on the law and politics modules. These comparisons suggest (i) that the improvement in the performance of the economics students was not the result of repeated testing with the same questions and (ii) that the questions did capture elements of the economic reasoning which the economics teaching was intending to develop.

For the third question about "externalities", where the question is exchanged between the first and second step, we found that there are no substantial differences between economists (18%) and the other students (22%) in the first survey. In the second survey, the differences are larger, as 66% of the economics students chose the correct answer, while only 41% of the other students chose the correct answer. This question is not included in the further analyses.

The aggregate analysis suggests that students enrolled in economics modules improved their understanding of economics, became more convinced about the efficacy of market-based policies, and became more positive towards those policies. We then compared the policy attitudes of those students in the economics modules who answered the economics knowledge questions correctly, and those who did not. We found no significant difference. This result might be generated by confounding differences at an individual level, so we now turn to individual level multivariate analysis.

4.3. Cross-Sectional Analysis of Knowledge and Preferences at Wave 2

We conducted cross-sectional regression analyses to examine associations between knowledge and policy preference after one semester of economics. The results are presented in Table 6. The knowledge variable in Table 6 is the aggregate of scores for the three multiple choice questions included in the second survey. We found no relationship between the end of semester knowledge and attitudes towards market-based instruments, but students who scored more highly on the knowledge questions, were less likely to support non-market instruments. Table 6 suggests two powerful influences upon attitudes towards environmental policy instruments. Students with a strong commitment to environmental sustainability and students who had more trust in political institutions, were much more likely to support either market-based or non-market intervention.

Table 6. Acceptance of Environmental Policy Measures In wave 2.

	Market Based Instruments	**Other Instruments**
Knowledge	−0.03 (−0.12, 0.06)	−0.04 (−0.13, 0.04)
Gender (female) [1]	0.14 * (0.01, 0.27)	0.13 * (0.01, 0.25)
Trust in institutions	0.19 *** (0.12, 0.27)	0.14 *** (0.07, 0.21)
Social trust	−0.04 (−0.11, 0.04)	−0.07 (−0.14, 0.00)
Ascribed personal environmental norm	0.46 *** (0.33, 0.59)	0.54 *** (0.42, 0.66)
Ideological position (left-right) [1]	−0.03 (−0.08, 0.03)	−0.06 * (−0.11, −0.01)
Constant	1.65 *** (1.06, 2.25)	1.68 *** (1.13, 2.24)
N *R*-sq	368 0.253	368 0.306

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. The value for the knowledge variable is from correct answers to the multiple-choice questions. [1] Value from the first wave.

4.4. Longitudinal Difference-in-Difference Analysis of Relationships between Knowledge and Attitudes

Finally, we examined the relationships between a change in attitude to environmental policies and a change in knowledge. Table 7 shows that we found no relationship between a change in knowledge and a change in attitudes. In fact, we found that students with a strong prior commitment to environmental sustainability strengthen their support for government intervention either through the market, or through other means. The final analysis, which examines whether there actually is a causal effect between knowledge and policy preference, is a difference in difference model. This model takes the longitudinal aspect of the study into account and therefore, could be claimed to better capture the causality between knowledge and policy preferences. The results are presented in Table 7. From these analyses, we do not find any relationship between the knowledge and acceptance of different environmental policy measures.

Table 7. Change in the acceptance of environmental policies: difference in difference analysis.

	Market Based Instruments	**Other Instruments**
Knowledge	−0.03 (−0.10, 0.05)	0.05 (−0.03, 0.12)
Trust in institutions	0.01 (−0.08, 0.10)	0.05 (−0.03, 0.14)
Social trust	−0.04 (−0.14, 0.05)	−0.11 * (−0.20, −0.02)
Ascribed personal environmental norm	0.45 *** (0.26, 0.64)	0.29 ** (0.11, 0.47)
Constant	0.16 *** (0.08, 0.23)	−0.08 * (−0.16, −0.01)
N *R*-sq	360 0.063	360 0.053

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

5. Discussion

We found that undergraduate students who enrolled in a module in introductory microeconomics improved their economic reasoning in ways that might be expected to influence their attitudes towards policies. Moreover, we did find that, on average, these students became slightly more supportive of market-based government environmental policies and slightly less supportive of non-market policies. However, our individual level analysis found no relationship between a change in attitude and a change in knowledge. This could be because our measures of economic reasoning were not sufficiently powerful to detect a change. However, aggregate students' performance on our main two questions increased from a success rate of 34%, to a success rate of 51% on one question, and from a success rate of 32%, to a success rate of 45% on another question. These changes indicate some substantive shifts in understanding which might be expected to influence attitudes. Moreover, our results are rather robust to alternative analyses, using different dependent variables (acceptance/perceived efficiency of different tools) and different operational definitions of our main independent variable (knowledge indices, question by question).

One possible explanation for the change in aggregate attitudes to policy instruments is that there is a 'socialisation effect' in economics teaching, which encourages a sense that market-based interventions are more normal than non-market interventions. One element in this may be a form of socialisation identified by [42], as 'following the ancestral leader'. Harring's study [33] showed how undergraduates converge towards acceptance of the views of their professor. However, there may also be a deeper level process at work. Undergraduates are inducted into the discipline of economics with the mantra that the subject offers a 'positive' depiction of the world that is free from any value

judgements [43]. Market solutions provide the focus for teaching (marginalising other forms of policy) and these solutions are also idealised as offering the best hope for the efficient maximisation of human welfare. Assumptions and values underpinning this focus and idealisation are largely hidden from view.

One possible explanation for the absence of a relationship at an individual level between attitudes and knowledge, is that attitudes are framed by powerful values that are resistant to change. Our data suggest that the attitudes to environmental policies examined in this study are very strongly framed by environmental values in a manner anticipated by value-belief-norm theory [21] and the theory of planned behaviour [44]. This interpretation presents a challenge to the traditional assumption of mainstream economics, that positive and normative judgements belong to separate domains.

Alternatively, it could be that the introductory undergraduate economics curriculum gives lecturers and students little space to explore the implications for policy of the principles that students are being encouraged to accept. It may, of course, be argued that economics major undergraduates will spend subsequent years engaging with the implications of economic analysis, for policies in different spheres. However, this leaves two questions to be answered, that have received little attention in previous research. First, to what extent does the treatment of relationships between theory and policy in first year economics build assumptions and beliefs about the subject which may prove problematic in subsequent study? [45] and, what happens to those students who only study economics for one semester?

We now consider some possible implications of these interpretations for the 'public understanding of economics', and the development of attitudes and reasoning amongst future experts in economics. Economic analysis strongly features in policy debate over public response to environmental problems. Public understanding of economics matters because (i) it constrains what policies are likely to achieve and (ii) the popularity of policies amongst voters affects policy makers' choices. A large proportion of undergraduates enrolled in first year economics modules do not proceed to an economics major. Therefore, it is pertinent to ask what influence this experience has upon the development of their attitudes towards economic policies, as well as the development of their economic understanding. Normalisation of the belief that governments can guide markets towards more efficient solutions through 'environmental' taxes and subsidies, would increase the scope for governments to intervene in this way. Of course, we cannot presume that governments would necessarily use this scope to act wisely. Therefore, the belief that this would be 'a good thing' largely depends on attitudes towards the balance between individual and collective responses to environmental issues and, therefore, belief in 'the tragedy of the commons'.

Our results raise an important question for the training of economists, who may exert substantial influence over the shape of future policy. We do find evidence that a single semester of teaching substantially improved undergraduates' understanding of some basic economic ideas. This is encouraging for teaching. However, we detected no relationship between changing understanding and changing attitudes to policy. This is troublesome for a profession that claims that its policy advice is derived solely from its rational analysis. There is a possibility that new economists are trained to believe that their own judgements are 'objective', when in fact they have been forged through normalisation, as they are inducted into the discipline.

Our research, therefore prompts some suggestions for future research. There is a need for better evidence on the relative effect of increasing economics understanding and social normalisation on the development of attitudes towards environmental policies. There is also a need for research into the effect of changing teaching strategies and changing the quantity of economics teaching on the development of attitudes towards, and beliefs about, environmental issues. In an era when the role of expert knowledge in policy formation seems to be diminishing, there is an imperative for disciplines to re-examine the ways in which they are shaping collective futures.

Author Contributions: Cecilia Lundholm directed the project; Peter Davies was co-investigator guiding the research design; Niklas Harring conducted the analysis; Niklas Harring, Peter Davies and Cecilia Lundholm drafted and revised the paper.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Questions Used in Pre- and Post-Surveys

1. "In an economy where heating oil is the primary source of heat for most households, new supplies of natural gas, a substitute for heating oil, are discovered. Natural gas provides heat at a much lower cost. What is the most likely effect of these discoveries on the market price and quantity of heating oil produced?"

	Price	Quantity
A.	Decrease	Decrease
B.	Decrease	Increase
C.	Increase	Decrease
D.	No change	No change

(Source TUCE, Microeconomics, question 1 [46])

2. "If all of the firms in a competitive industry are legally required to meet new regulations that in-crease their costs of production:

A. supply of the product will decrease.
B. demand for the product will decrease.
C. the long-run economic profits of individual firms in the industry will decrease.
D. the short-run economic profits of individual firms in the industry will increase."

(Source TUCE Microeconomics, Question 3, [46])

First survey only

3. "One reason why the free market fails to achieve an optimal allocation of scarce resources is because

A. public goods are provided free of charge to users.
B. positive externalities lead to overproduction of a good.
C. there is underproduction of goods with positive externalities.
D. individuals' incomes and wealth are not identical."

(Source AQA Economics 2011 Unit 1 January 2011 Q20, question no longer available online)

Second survey only

4. "Traffic congestion in cities and towns provides an example of the market failing to reach a socially optimum level due to:

A. negative externalities of private car travel.
B. positive externalities of private car travel.
C. marginal social benefits exceeding marginal private benefits.
D. marginal private costs exceeding marginal social costs.
E. marginal private benefits of car travel equalling marginal social benefits."

(Source Question from Economics Network question bank [47])

References

1. European Commission. Climate Action: Paris Agreement. Commentary on the Paris Climate Conference COP21. Paris, France, December 2015. Available online: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed on 28 February 2017).
2. Davies, P. Educating citizens for changing economies. *J. Curric. Stud.* **2006**, *38*, 15–30. [CrossRef]
3. Weber, E.U.; Stern, P.C. Public understanding of climate change in the United States. *Am. Psychol.* **2011**, *66*, 315. [CrossRef] [PubMed]
4. Arbuthnott, K.D. Education for sustainable development beyond attitude change. *Int. J. Sustain. High. Educ.* **2009**, *10*, 152–163. [CrossRef]
5. Green, T.L. Introductory economics textbooks: What do they teach about sustainability? *Int. J. Plur. Econ. Educ.* **2012**, *3*, 189–223. [CrossRef]
6. Green, T.L. Lecturers' perspectives on how introductory economics courses address sustainability. *Int. J. Sustain. High. Educ.* **2015**, *16*, 44–56. [CrossRef]
7. Lundholm, C.; Davies, P. Conceptual Change in the Social Sciences. In *International Handbook of Research in Conceptual Change*, 2nd ed.; Vosniadou, S., Ed.; Routledge: London, UK, 2008; pp. 288–304.
8. Scott, J.H., Jr.; Rothman, M.P. The effect of an introductory economics course on student political attitudes. *J. Econ. Educ.* **1975**, *6*, 107–112. [CrossRef]
9. O'Brien, M.U.; Ingels, S.J. The Economics Value Inventory. *J. Econ. Educ.* **1987**, *18*, 7–17. [CrossRef]
10. Cobb, S.L.; Luker, W. A test of interventionist/noninterventionist attitudes: A question of market bias in microeconomics. *J. Econ. Issues* **1993**, *27*, 363–372. [CrossRef]
11. Marcis, J.G.; Deck, A.B.; Bauer, D.L. An exploratory study of differences in students' views of the market system. *J. Econ. Econ. Educ. Res.* **2014**, *15*, 121–129.
12. Cokgezen, M.; Cilingirturk, A.M. Attitudes of Turkish students against markets: Does studying economics matter? *Int. J. Soc. Econ.* **2014**, *41*, 944–955. [CrossRef]
13. Lephardt, N.E.; Breeden, C.H. The Market Attitudes Inventory: The Development and Testing of Reliability and Validity. *J. Econ. Econ. Educ. Res.* **2005**, *6*, 63–72.
14. Davies, E.; Parker, D.F. Students' attitudes toward regulation, politics, and free enterprise. *J. Leg. Ethical Regul. Issues* **2004**, *7*, 155–168.
15. Davies, P.; Howie, H.; Mangan, J.; Telhaj, S. Economic aspects of citizenship education: An investigation of students' understanding. *Curric. J.* **2002**, *13*, 201–223. [CrossRef]
16. Davies, P.; Lundholm, C. Young people's understanding of socio-economic phenomena: Conceptions about the free provision of goods and services. *J. Econ. Psychol.* **2012**, *33*, 79–89. [CrossRef]
17. Shiller, R.J.; Boycko, M.; Korobov, V. Popular Attitudes towards free markets: The Soviet Union and the United States Compared. *Am. Econ. Rev.* **1981**, *81*, 385–400.
18. Cipriani, G.P.; Lubian, D.; Zago, A. Natural born economists? *J. Econ. Psychol.* **2009**, *30*, 455–468. [CrossRef]
19. Haucap, J.; Just, T. Not guilty? Another look at the nature and nurture of economics students. *Eur. J. Law Econ.* **2010**, *29*, 239–254. [CrossRef]
20. Lange, A.; Pitsoulis, A. Sources of politico-economic attitudes: Students' introspections. *Soc. Psychol. Educ.* **2013**, *16*, 45–76. [CrossRef]
21. Stern, P.C.; Dietz, T.; Abel, T.D.; Guagnano, G.A.; Kalof, L. A value-belief-norm theory of support for social movements: The vase of environmentalism. *Res. Hum. Ecol.* **1999**, *6*, 81–97.
22. Oreg, S.; Katz-Gerro, T. Predicting proenvironmental behaviour cross-nationally: Values, the theory of planned behaviour, and value-belief-norm theory. *Environ. Behav.* **2006**, *38*, 462–483. [CrossRef]
23. Steg, L.; Vlek, C. Encouraging pro-environmental behaviour: An integrative review and research agenda. *J. Environ. Psychol.* **2009**, *29*, 309–317. [CrossRef]
24. Tikir, A.; Lehmann, B. Climate change, theory of planned behavior and values: A structural equation model with mediation analysis. *Clim. Chang.* **2011**, *104*, 389–402. [CrossRef]
25. De Leeuw, A.; Valois, P.; Ajzen, I.; Schmidt, P. Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *J. Environ. Psychol.* **2015**, *42*, 128–138. [CrossRef]

26. D'Souza, C.; Taghian, M.; Khosla, R. Examination of environmental beliefs and its impact on the influence of price, quality and demographic characteristics with respect to green purchase intention. *J. Target. Meas. Anal. Mark.* **2007**, *15*, 69–78. [CrossRef]
27. Soper, J.C.; Walstad, W.B. On Measuring Economic Attitudes. *J. Econ. Educ.* **1983**, *14*, 4–17. [CrossRef]
28. Tietenberg, T.H.; Lewis, L. *Environmental and Natural Resource Economics*; Routledge: London, UK, 2016.
29. Davies, P.; Mangan, J.; Telhaj, S. Bold, reckless and adaptable? Explaining gender differences in economic thinking and attitudes. *Br. Educ. Res. J.* **2005**, *31*, 29–48. [CrossRef]
30. Steg, L.; Sievers, I. Cultural theory and individual perceptions of environmental risks. *Environ. Behav.* **2000**, *32*, 250–269. [CrossRef]
31. Whaples, R. Changes in attitudes among college economics students about the fairness of the market. *J. Econ. Educ.* **1995**, *26*, 308–313. [CrossRef]
32. Kallbekken, S.; Kroll, S.; Cherry, T.L. Do you not like Pigou, or do you not understand him? Tax aversion and revenue recycling in the lab. *J. Environ. Econ. Manag.* **2011**, *62*, 53–64. [CrossRef]
33. Magee, C. Do professors' opinions affect students? In *Forum for Social Economics*; Springer: Dordrecht, The Netherlands, 2009; Volume 38, pp. 135–151.
34. Harring, N.; Lundholm, C.; Torbjörnsson, T. The Effects of Higher Education in Economics, Law and Political Science on Perceptions of Responsibility and Sustainability. In *Handbook of Theory and Practice of Sustainable Development in Higher Education*; Leal Filho, W., Brandli, L., Castro, P., Newman, J., Eds.; Springer: Berlin, Germany, 2017; Volume 1, pp. 159–170.
35. Pascarella, E.T. How college affects students: Ten directions for future research. *J. Coll. Stud. Dev.* **2006**, *47*, 508–520. [CrossRef]
36. Vedung, E.; Bemelmans-Videc, M.L.; Rist, R.C. Policy instruments: Typologies and theories. *Carrots Sticks Sermons Policy Instrum. Eval.* **1998**, *5*, 21–58.
37. Harring, N. Reward or Punish? Understanding Preferences toward Economic or Regulatory Instruments in a Cross-national Perspective. *Political Stud.* **2015**. [CrossRef]
38. Shanahan, M.P.; Foster, G.; Meyer, J.H.F. Operationalising a threshold concept in economics: A first attempt using multiple choice questions on opportunity cost. *Int. Rev. Econ. Educ.* **2006**, *5*, 29–57. [CrossRef]
39. Dunlap, R.E.; Van Liere, K.D.; Mertig, A.G.; Jones, R.E. New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised NEP scale. *J. Soc. Issues* **2000**, *56*, 425–442. [CrossRef]
40. Hammar, H.; Jagers, S.C. Can trust in politicians explain individuals' support for climate policy? The case of CO_2 tax. *Clim. Policy* **2006**, *5*, 613–625. [CrossRef]
41. Harring, N.; Jagers, S.C. Should we trust in values? Explaining public support for pro-environmental taxes. *Sustainability* **2013**, *5*, 210–227. [CrossRef]
42. Griskevicius, V.; Cantu, S.M.; van Vugt, M. The evolutionary bases for sustainable behavior: Implications for marketing, policy, and social entrepreneurship. *J. Public Policy Mark.* **2012**, *31*, 115–128. [CrossRef]
43. Colander, D.; Klamer, A. The making of an economist. *J. Econ. Perspect.* **1987**, *1*, 95–111. [CrossRef]
44. Ajzen, I. The theory of planned behaviour: Reactions and reflections. *Psychol. Health* **2011**, *26*, 1113–1127. [CrossRef] [PubMed]
45. Davies, P.; Mangan, J. Threshold concepts and the integration of understanding in economics. *Stud. High. Educ.* **2007**, *32*, 711–726. [CrossRef]
46. Walstad, W.B.; Watts, M.; Rebeck, K. *Test of Understanding of College Economics Examiners' Manual*, 4th ed.; National Council for Economic Education: New York, NY, USA, 2006.
47. Assessment Question Bank. The Economics Network. Available online: https://www.economicsnetwork.ac.uk/qnbank/ (accessed on 22 February 2017).